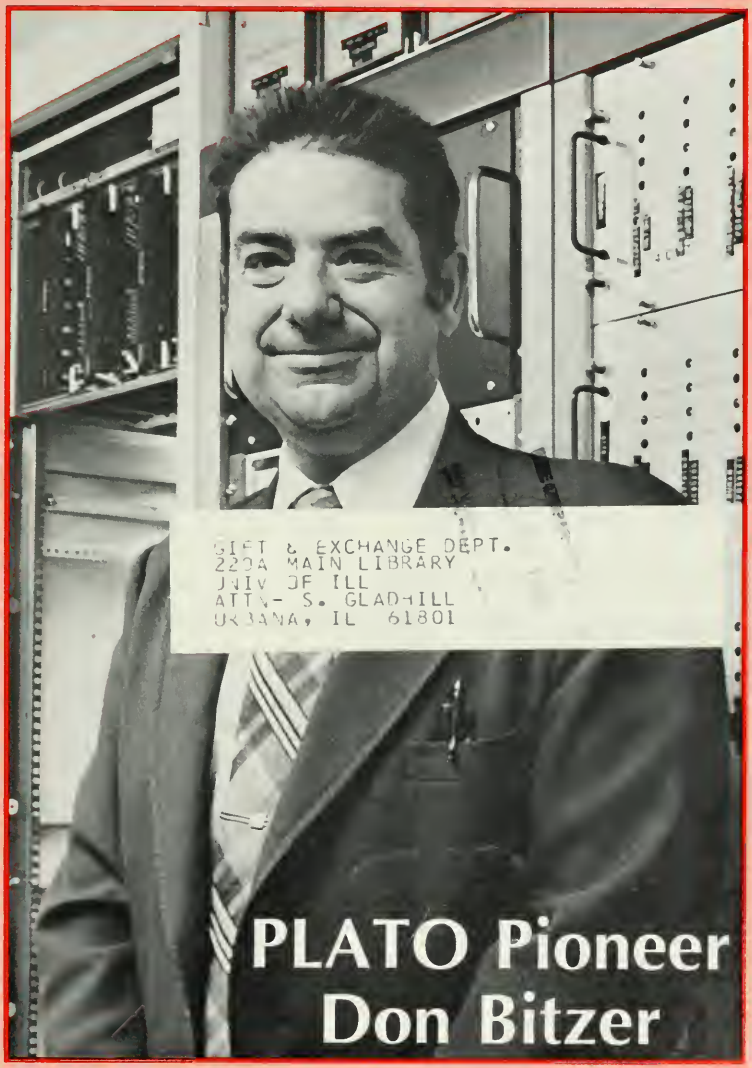
ILLINOIS TECHNOGRAPH



PLATO Pioneer Don Bitzer

February 1981

Volume 96 issue 3

Will you like Alcoa? Ask the people who work there.

"Alcoa is very concerned with safety and environment. We're proof that large companies can be people-oriented too."
Larry Carlson, R&D, Massena, New York

"I love where I work. The environment is conducive to my personal growth and the job is challenging."
Joyce Asahi, Personnel, Wenatchee, Washington

"I'm encouraged to give input. And I've seen some of my ideas used, which is very rewarding."
Carlton Holley, Mechanical Engineering, Davenport, Iowa

For career information, write Aluminum Company of America, 1245 Alcoa Building, Pittsburgh, Pennsylvania 15219. Alcoa is an equal opportunity employer.

ALCOA

"I had no idea how much action DuPont offers an ME. I'm glad I asked."

Jorge Lopez BS, Mechanical Engineering

"When I interviewed with DuPont at The U. of Minnesota, I was amazed to learn that 25% of its engineers were MEs, and that they play important roles in the design, construction and supervision of vital mechanical systems.

"My first job at DuPont was challenging. It was up to me to see that construction on the new polyethylene plant at Victoria, Texas, met design specs. After start-up, it was my responsibility to make sure the plant produced the promised capacity. Right out of school, I was dealing with large capital expenditures.

"The variety of assignments has kept it challenging and interesting. For example, I helped to redesign a centrifugal pump to get rid of vibration. I'm currently on the design committee working to isolate and reduce emissions in a nylon intermediates plant."

If you want to make full use of your abilities and enjoy doing it—whether you're an ME, ChE, or EE—see our Representative when he's on campus. Or write DuPont Company, Room 37799, Wilmington, DE 19898.

At DuPont...there's a world of things you can do something about.

DUPONT

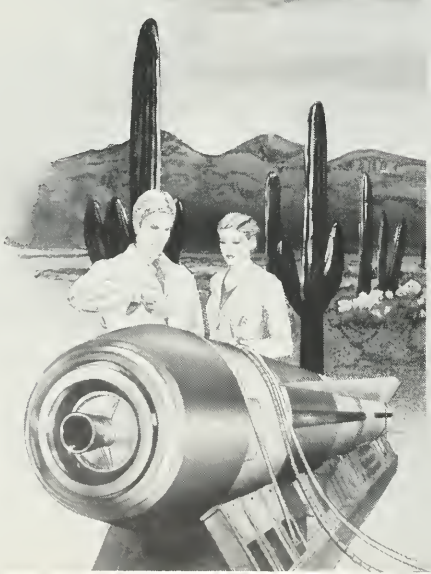
REG U.S. PAT & TM OFF

An Equal Opportunity Employer, M/F

Imagine yourself designing a sonar system that can locate any ship in the ocean.

Imagine your team creating a simulator that duplicates in 3-D any situation a pilot might experience.

Imagine your group building the system that will safeguard the United States.



Imagine yourself at Hughes

. . . working on innovations that could change the world.

. . . taking advantage of Hughes' continuing education program — one of the finest in the country.

. . . enjoying the Southern California lifestyle.

Hughes Aircraft Company
College Relations
P.O. Box 90515
Los Angeles, CA 90009.

At Hughes,
your future is limited only by your imagination.

HUGHES

HUGHES AIRCRAFT COMPANY

Proof of U.S. Citizenship Required
Equal Opportunity Employer

ILLINOIS
TECHNOGRAPH

February 1981 Volume 96 issue 3

On the cover: One of the University's outstanding engineering achievers—PLATO pioneer Don Bitzer. photo by Randy Stukenberg

The **Technograph** invites letters in response to its articles and editorials, or any other topics of interest to our readership. Articles, photographs or other contributions will also be considered. Letters must be signed, but names will be withheld upon request.

EDITORIAL

The Fourth Year Itch

This illness is much worse and more contagious than even the Bangkok flu. I know, because early this semester I was suffering from both. The flu left me after three days of "All My Children," but the other plight will not be cured until the middle of May.

The early symptoms include morning headaches (the medical term is hangover), inability to maintain concentration during periods of intense class, and an insatiable desire to get haircuts and dress up in three-piece suits.

If you have not diagnosed it by now, you must be an underclassman or graduate school candidate, for the malaise I suffer from is called—senioritis. It attacks seniors of all majors, except accountants, who have an immunity called the CPA exam. It starts slowly at first, gets worse around spring break and by the end of April it becomes critical.

The typical victim is in the position I am right now, looking for a job in the "real" world. The motivation to do this springs from the lack of interest in grad school and the fear of returning home to hang around with the old gang at the local dive. You can recognize people like this because they come to class in suits instead of Levi's, talk about interviews like they used to talk about dates and have their hair cut as often as they used to shave.

Then there is the person with an exceptionally advanced case of employment fever. This guy is the employment office's statistical dream. He has a GPA of 5.01 out of 5.0, is a member of every honor society on campus, including three named in his honor, and has more hours of interviews a week than you have of classes. Because of this he suffers from the inability to sleep past 5:30 a.m. on Saturday mornings. This person flies on so many plant trips that he has become a personal friend of O.J. Simpson and Frank Borman.

After a few interviews and a job offer the senioritis sufferer moves into the chronic stage. For him jobs are now a secondary concern as he has developed a voracious appetite for "play." This is the part of senioritis known as the "blow-off syndrome."

You know you have reached this stage when you are driven to shirk responsibility in order to have fun. You blow—off your girlfriend to drink beer, your job to play golf, your homework to watch a movie, and your classes because its amphibian appreciation day.

It is now that you are approaching the critical stage—finals. The final finals. Even though you have not been to classes in three weeks you still choose to study tanning rays not optic rays, to read **Vogue** not Voltaire, and to be rythmic at Mabel's not study logrithmic tables.

It is at this stage that you finally realize classes and grades do not matter anymore. That morning sophomore year, when you missed the pop quiz, did not prevent your graduation. That time you needed an extension on your lab report, to take a road trip to Southern, did not cost you a job. What is important is that you finished what you started and enjoyed it while it lasted.

Russ Schreiner

LETTERS

To the editor,

I read with interest your editorial in the December issue of the **Technograph**. I share your sense of outrage at the interference to stereos (and televisions) by amateur radio and other transmitters. Not only does it disrupt a pleasant listening atmosphere, but if it continues long enough it renders useless our investment of many hundreds of dollars in high-fidelity equipment. We paid for it, so shouldn't we be allowed to listen in peace?

The signals transmitted by the Amateur Radio Club may be defective or out of their assigned bands. The FCC (Federal Communications Commission) is constantly alert for this kind of improper transmission, since it is their job to regulate all forms of radio transmission. However, they have concluded that the Radio Club is "clean."

The student members of the Radio Club are neither "pirates" nor "rookies" as you describe them in your editorial. They are mostly electrical engineers who have considerable experience with radio transmitters and their operation. They have passed a comprehensive series of examinations before the FCC and they have a great concern for the proper operation and maintenance of their equipment. They are exercising their legal rights and privileges; they are "public nuisances" only to those who are ignorant of the technical facts. Is the engineer of a freight train a nuisance because you lie down on the tracks in front of him? I think not.

There is every reason for persons experiencing interference to contact the Radio Club. In a large number of cases they have added the simple and inexpensive capacitors which completely solved the problem. For you to encourage people to harass Professor Albright is entirely irresponsible. He, of all people, fully understands the problem, and he has many better things to do than to listen to complaints.

For you to indulge in barely restrained name-calling is journalistically immature. For you to continue your attack on innocent, legal, radio amateurs after you have been shown that the source of the problem lies entirely in your own apartment is disappointingly naive and incompetent.

Yes, I share your outrage at the problem of radio interference, but my outrage is at the manufacturers of stereo equipment who, for the saving of approximately 50 cents, produce devices susceptible to radio interference. And I am outraged by the attitude and disgraceful response of fellow scientists, like you, who should know better than to condemn and slander those who you admit are not at fault.

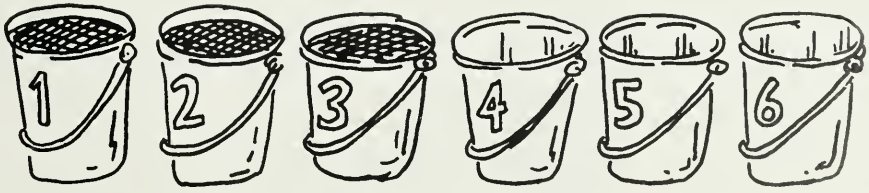
Michael R. Owen
Department of Geology

TECH TEASERS

1. If a man and a half can dig a hole and a half in a day and a half, how long does it take half a man to dig half a hole?

2. If an acre and a half can grow a foot and a half in a month and a half, how long does it take half an acre to grow half a foot?

3. By moving only one of the six pails, line them up so that full pails and empty ones alternate:



4. An alien spacecraft has landed in a rectangular field. It is 33 meters from one corner of the field and 17 meters from the diagonally opposite corner. If the distance to a third corner is 37 meters, what is the distance to the remaining corner?

5. A clever explorer is captured by savages. They make him a very generous offer. "Make a statement," they tell the clever explorer. "If what you say is true, you will be hanged. If it is false, you will be shot."

As was mentioned before, the explorer is clever. What does he say to save his life?

Answers on page 32

House of **Faithful Sound**

by **Larry Mallak**

On the corner of Clark and Busey in Urbana, just outside the massive Carle Hospital construction site, is a little grey house. Don't be fooled by the blacksmith sign posted in the front entrance, it's actually a modern four-track recording studio. The studio goes by the name of Faithful Sound. Mark Rubel, studio director and bass player for Captain Rat and the Blind Rivets, lives in the house with his dog Pogo.

Faithful Sound is the result of the collaboration of mostly U of I electrical engineering graduates. The studio was founded by Peter Penner in January, 1980. Penner fulfilled a life-long desire to manage a studio. His goal was to combine artistic expression with science. Penner accumulated most of the equipment in the studio himself, modifying it to suit his needs.

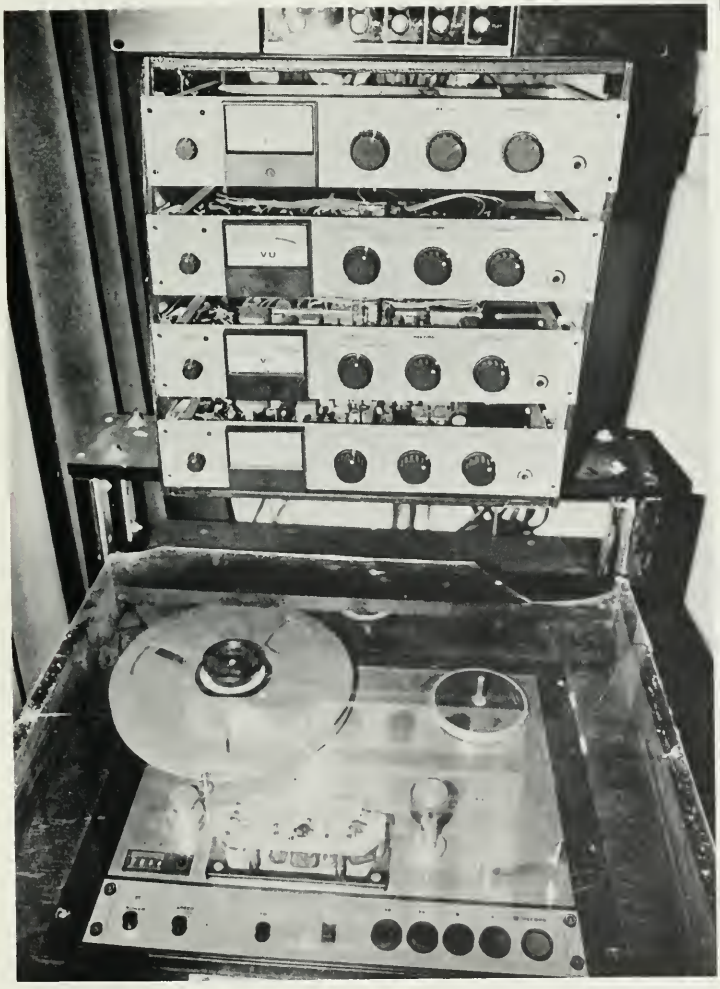
With the exception of the reverb unit, the studio equipment was obtained secondhand. Rubel cites the story of the delivery of the mixing board: "It came from a polka studio in New Jersey. We tore the rear end out of a car, and brought it back in a trailer. I think it sat in somebody's barn wrapped in plastic for three months. Every piece of equipment in here has some ridiculous story behind it."

The people behind Penner and his Faithful Sound are technical director Tim Vear, chief engineer Johnse Holt, Mario Delahuerga, Chris Abele, Bob Slade, recent addition John Schur, and Rubel. All are EE graduates except Holt and Rubel.

Standard procedure for a band coming in to record a demo is to meet with the studio staff and work out details. This includes the number of recordings to be made, the style of sound, the number of musicians, a listing of instruments and the band's specific production notes. Tentative engineers, producers and session dates are set up as well as a request for studio techniques (dubs, equalization, reverb).

Next, the players and their instruments are placed in separate rooms and careful miking procedure is followed. Separation of the band members allows the engineer to vary levels of audio input from different sources and preserves the unity of the instrument's sound on its respective track. Miking procedures can be tedious and care must be taken to keep unwanted noise out. Special care must be taken to avoid noise from drums; thus the need for separate acoustically sealed rooms.

During a recording session, the instruments are recorded on two stereo tracks with vocals placed on a separate track. This enables the replacement of the vocals with new or altered vocals. Four-track recording limits the technical flexibility since all sounds are recorded at once. Rhythm tracks are laid to be overdubbed with solos at a later stage in



Clockwise from far left:

Studio director Mark Rubel on the controls of the mixing board console. All audio signals are relayed to this console in Studio A where the sound engineer monitors and adjusts as needed. photos by Randy Stukenberg

This lonely, abandoned-looking piece of carpentry in northern Urbana encases a recording studio. Boarded windows preserve the acoustic nature and insure minimal glass breakage.

Modified tube equipment, rather than solid state circuitry, is found in this recording studio. Shown here is the Tascam 70LX on which the half-inch masters are made.

the production. Four-track recording can be optimized by a method called "ping-ponging" which Rubel describes as the process of mixing all the channels into one, allowing for three more channels to be added. The channels are then mixed down, and the process can continue indefinitely until hiss and noise reaches unacceptable levels.

Two schools of recording exist, classical and modern. Classical recording, utilized in areas such as Krannert Center for the Performing Arts, captures the sound as it actually happened. The sound is piped directly from the mikes through the mixing boards to the tape machine with no studio tricks enployed.

Modern recording deals with multiple track taping, making all recording "dry" (no echo) and isolating each sound. Component sounds are then mixed as desired with artificially induced sounds along with variations of existing sounds. Recording in this manner is a more complicated process and gives the producer more control over the product, thereby allowing more creativity.

Production techniques deviate as related to the dominant sound of different bands. Regarding recent sessions with the Vertebrats and the Unwanted, Rubel said, "We were really going for the 'raw' sound. That, I think, is the way to record them. When you record the Vertebrats you don't want it to be real slick and pop and produced because they're not."

Tube equipment, left in the dark by larger studios opting for the latest electronic wizardry, comprises most of Faithful Sound's studio. Rubel says that tube equipment is superior to solid state in that tube-produced sounds are war-

mer, richer, and more live. According to Rubel, this is because even harmonics are amplified by the tube, while the odd harmonics are amplified by solid state amplifiers. This gives recordings a pinched, nasal, wheezy sound. The tone of the music, made up of a series of overtones, is dependent on the balance of those overtones. "There's a big resurgence in tube equipment. They're realizing that it sounds better and that's what is important," said Rubel.

For sound enhancement, the studio uses tube graphic equalizers, which attentuate desired frequencies. They do not boost signals, but merely cut designated freqencies. Another type of equalizer, the parametric equalizer, allows the producer and engineer control over greater parameters by boosting or cutting certain signals over a desired frequency range and by regulating how much is to be boosted or cut.

Echo sensation is accomplished through a reverb mechanism. Reverb simulates being in a room of a certain size and shape and permits the producer more control over the sound. Since all sounds are recorded "dry" in multitrack studios, the reverb plays an integral part of the production. The effect of reverb is summed up by Rubel: "The way that the brain, but we call it the ear, detects what size room you're in is by the echo."

Rubel's studio uses a spring reverb. A signal is fed to a transducer which vibrates the springs inside. Sound is delayed by its movement in the spring until a pick-up at the opposite end returns the sound to the mixing board. Fooling the ear is the gist of the game. The ratio of direct to reflected sound is adjusted as desired for the type of recording to be processed.

"I'm not interested in new technology. Old Doors' stuff just sounds so great. I don't know what it is about it. The silences on it are beautiful." Rubel believes in approaching the music simplistically and not adding more to a tape once the message of the song is achieved. "They (24-track studios) can't get as simple as we can. They've got all this circuitry. They're running a signal, which represents a musical note or a human voice, through all kinds of weird circuitry and transformers. It's bound to change the sounds, and it does."

"When bands play, I like having a real rock and roll event," remarked Rubel. "With the Vertebrats or Kool Ray, when they play, it's a real scene. I like that. I like the mythology of rock and roll. It's obviously derivative. A lot of uninspired people are hopping on the bandwagon. I think the Talking Heads' new album is the music of the 80's. It's true progressive music."

"From an engineering point of view, studio people can tend to get very technical. They'll tend to look at everything in terms of test equipment. They'll put something on the scope and see if it checks out. I think that the final test is the ear. It's too easy to lose sight of the music, and that's what it's really about," concluded Rubel.**T**

TBII—TECHNOGRAPH ENGINEERING STUDENT WRITING CONTEST

Theme—"The Value of the Engineer's Social Involvement on Campus"

PRIZES:

FIRST PLACE—$100
SECOND PLACE—$50
THIRD PLACE—$25

Entries must be 300-500 words long and are due on February 23, 1981 at 5:00 p.m. in 302 Engineering Hall.

First and second place winners will appear in the Engineering Open House Program.

The Challenge . . .

In today's complex technological society, it takes exceptional planning and engineering to build a better tomorrow. The Corps of Engineers' dedicated civilian professionals . . . engineers, planners and environmentalists, biologists, economists, landscape architects . . . are working on a variety of jobs in a variety of places in the U.S. and overseas to improve and protect the quality of life for all citizens. We plan, design, construct and operate water resource projects, build and improve our nation's ports and harbors, build hospitals and housing projects for the Defense Department. The development of these projects must be carefully balanced with the preservation of our natural environment. The balance is precarious, the challenge extreme. As a civilian employee with the Corps of Engineers you will be joining an organization that believes people are our most important asset. People who respond to a challenge with commitment, skill and innovation. You can help us meet the challenge. Ask us and we'll tell you more about a career with the Corps of Engineers.

US Army Corps of Engineers

An Affirmative Action
Equal Opportunity Employer

Corps of Engineers/Department of the Army/Washington, D.C. 20314

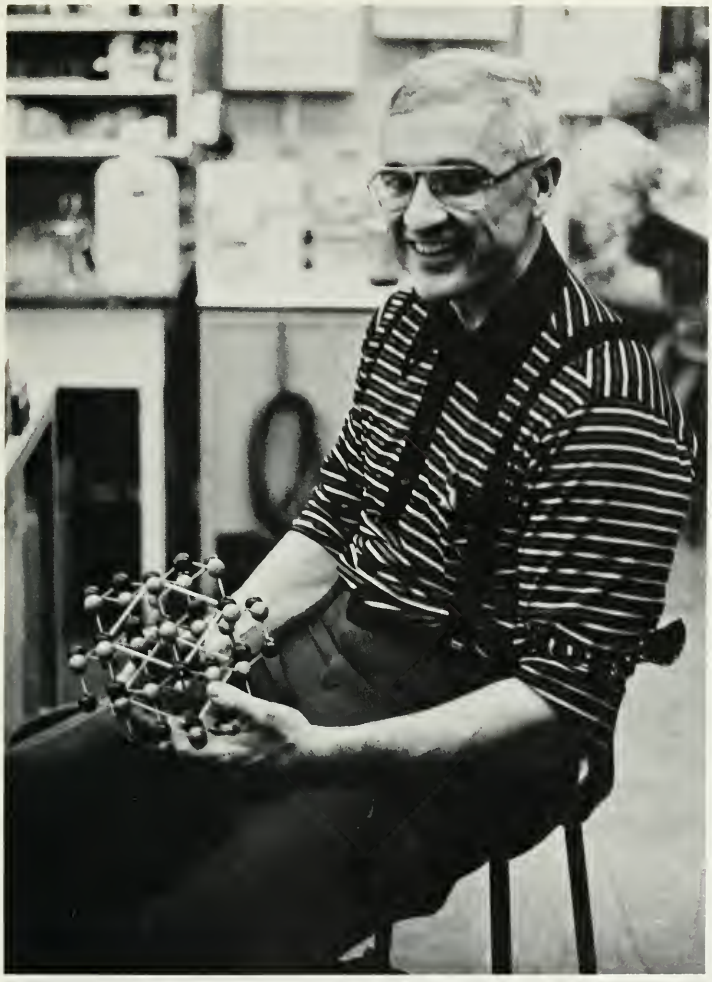
Sound, Structures and Semiconductors

Great Discoveries at the University

by **Kevin Wenzel**

In the beginning there was nothing, then in 1867 there was the University of Illinois. The impact of the accomplishments of people at the University has been widespread and of great consequence. The University hosted the first night-time indoor football game when the Fighting Illini lost to the Carlisle Indians 26 to 6 in 1897. In 1902, the first collegiate cheerleader, Red Matthews, an engineering student, appeared on campus. The first homecoming celebration was in 1910. In the same year, the Marching Illini became the first band to perform difficult maneuvers while playing. After only 43 years it became obvious that the University would be a great contributor to the betterment of human life.

Besides advances in sports and entertainment, the University also made academic improvements. In 1870 the University boasted the first shop for engineering education in the United States. The University produced the first architecture graduate in America, followed by the first architectural engineering course in 1890. The first Engineering Experiment Station was estab-



Clockwise from far left:
Nick Hollonyak, inventor of the light emitting diode.
Nobel Prize winner John Bardeen.
PLATO engineer Don Bitzer. photos by Kevin Wenzel

lished here also. These accomplishments all formed the foundation for the reputation the University has today as a fine engineering school.

People, as well as an effective administration, helped improve the University's reputation. In 1885 Arthur Talbot took a position as an assistant professor in engineering and mathematics. Talbot began the long tradition of new developments here. He developed engineering standards with his equations that related rates of water run-off to the size of the waterway. He also developed the "Talbot Spiral" which allowed for jolt-free gradual curved railroad tracks. For his accomplishments Talbot received international acclaim which attracted more fine engineers to the University.

One such engineer was Jacob Kunz, an electrical engineer who came to Illinois from Switzerland in 1909. Kunz was interested in astronomy, particularly measuring the light from stars. In 1915 Kunz perfected the photoelectric cell which measured light by changing it to electrical pulses. The cell replaced the selenium cell because it was more accurate and did not suffer from lag or fatigue after repeated use.

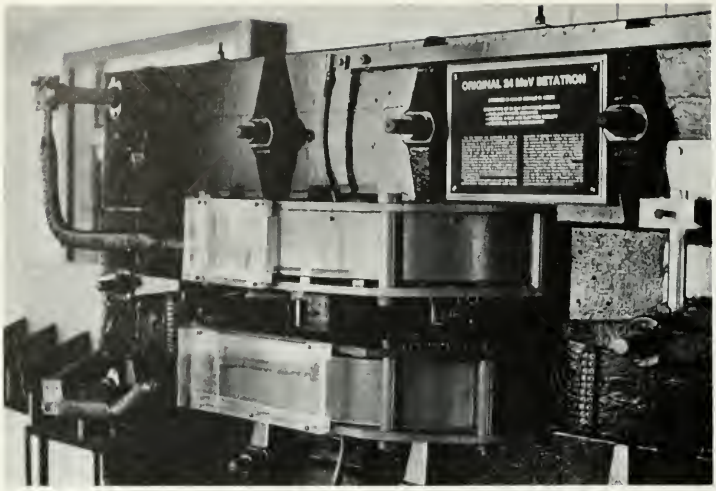
Another engineer attracted by the reputation of the University was Wilbur Wilson. He supported the new ridge-frame bridge which was simpler, cheaper to build and stronger than old bridges. Gradually this became the most popular style of bridge. Wilson was also interested in the deterioration of bridges, but he disliked waiting for the deterioration to occur naturally. To this end, he developed testing machines to simulate nature in shorter periods of time. Wilson also proved to the construction industry that bolts could be used in place of rivets in large steel structures. High-strength bolts were faster and cheaper to use. Many people said this was impossible, but Wilson's ideas were proven in structures like the Pan American Buiding in New York with over 4 million bolts.

Joseph Tykociner came to the University in 1921. Tykociner was noted for his work on relating sound to motion pictures.

"I saw projected on the screen athletic, military and simple dramatic scenes. I was impressed by the technical achievement, but the absence of sound made the show unnatural...," said Tykociner. Tykociner hypothesized two ways to record sound. First, he used sound to vary the pressure in a gas lamp, and then recorded the changes in the light on photographic negatives. This was difficult because the negatives were glass and it required complex methods to pass the film past the lamp. Second, he used a vibrating shutter controlled by a telephone receiver diaphragm to vary the amount of light which struck the film.

Tykociner needed a photosensitive cell, and this is where Kunz's cell came into play. Tykociner had problems using the cell, however, because he lacked the proper equipment. He borrowed tubes from the student radio station, and projectors from the agriculture department. Despite the problems of funding, equipment and skepticism, several movies with a sound tracks were produced by March of 1922. Shortly after the first public demonstration of sound on film, Tykociner's work was halted due to disagreements with the University over patents. For this reason, he was never credited for the development of talking movies.

About the same time in the Mechanical Engineering Department, Arthur Cutts Willard and Alonzo P. Kratz were working on collecting data and defining in precise terms a method for grading



The original 24 MeV Betatron as seen in the foyer of Loomis Lab.

furnaces and ventilation systems. Kratz and Willard developed the equipment used to measure air flow and temperature. In 1920 Willard was named head of the ME Department, and in the same year the University was asked to study the ventilation for a proposed tunnel connecting New York and New Jersey.

The tunnel would be 9250 feet long and have the capacity for 3800 vehicles per hour. A major problem was to keep the carbon monoxide concentration under 4 parts per 10,000 parts of air. It was decided that eight foot diameter fans in the bottom and along the top of the tunnel would provide sufficient air flow. These fans had the enormous task of moving 3.75 million cubic feet of air per minute to maintain the desired concentration of carbon monoxide. The $48 million tunnel took seven years to complete and included 84 of the fans running on 6,000 horsepower to change the air inside the tunnel every 1.6 minutes. Arthur Willard went on to become the president of the University after his great achievements.

During the depression the University had trouble funding research. A mechanical engineer, Herbert F. Moore, was interested in conducting research on railraid track break, a major problem since 12,000 rails failed every year. Moore almost had to abandon his study because of money problems, but the Rail Manufacturers' Technical Committee and the American Railway Engineering Association offered him $50,000 per year for five years to find the cause of track failures. Early in 1930 the Materials Testing Laboratory at the University took on the appearance of a railroad yard with wheels and track arriving every day.

After studying the fissures that occured in tracks with acid etch tests, Moore found that all had originated from smaller breaks or "shatter cracks." Exhaustive tests were developed and undertaken which included running tracks under varying wheel loads, dropping 2,000 pound weights on tracks, and bend tests. Moore and his team collected massive amounts of data, none of which proved conclusive. Finally, I. C. Mackie, a metallurgist from a steel mill in Nova Scotia, discovered that shatter cracks contained hydrogen. New methods for cooling steel tracks were developed by Moore and the Carnegie-Illinois Steel Corporation in Sydney, Nova Scotia. This eliminated the hydrogen problem and the incidence of track failure was greatly reduced.

The depression hit other departments as well, but despite the money crunch, the Physics Department hired Donald Kerst and Robert Serber. They were offered $400 to build an electron accelerator. Only nine months after Kerst began working at the University, Wheeler Loomis, head of the Physics Department, announced the invention of the betatron, which could accelerate electrons to extremely high energy levels. On July 15, 1940 the betatron was tested for the first time, producing 2 million volts. By 1942 a second betatron which could produce energies of up to 20 million volts was operating at the University.

The betatron had widespread usage. It produced X-rays used to find flaws in metal parts and to kill malignant growths in hospital patients. Although the betatron was not used much after 1950, the magnetic properties Kerst incorporated are still used in many branches of physics.

John Bardeen, inventor of the transistor, could have made the betatron much smaller in size. However, it wasn't until 1948 that Bardeen and his colleagues at Bell Labs perfected the point contact transistor. Today, almost everything has been miniaturized by the use of transistors. Bardeen who came to the University in 1951, was honored with a Nobel prize in 1956.

A contemporary of Bardeen's was Nathan Newmark, a civil engineer. In 1950 he was asked to serve as a consulting engineer during the construction of the Latino Americana Tower in Mexico City. This presented problems because of the abundance of earthquakes and lack of solid ground to build upon. Newmark advised that a better design would allow the building to go up to 43 stories. He designed a "floating-box" foundation consisting of 361 concrete pillars driven 117 feet into the ground. This design, as well as the light-weight construction of the building itself, would allow the building to keep standing during earthquakes three times stronger than any that had hit Mexico City before. The earthquake of 1957 proved Newmark's design to be sufficient. The building was still standing after its top had been shaken nearly a foot sideways.

In the meantime, John Bardeen was working with Leon Cooper and John Schrieffer on the theory of superconductivity. The theory states that some metals will allow an electric current to flow infinitely when at the right temperature. From this discovery stemmed the creation of small, super-electromagnets. These have a variety of uses ranging from the containment of thermonuclear fusion reactions to magnetic railroad lines for supporting trains. The three physicists who worked on this project were awarded a Nobel Prize in 1972.

During the 1950's computers were being developed and coming into their own, and educators at the University were beginning to think about how these machines could be used to teach students. The major problem with this idea was getting psychologists, educators and engineers to agree on a method for teaching with machines. A committee headed by Daniel Alpert, the Director of the Control Systems Laboratory, decided it could not be done. Alpert convinced electrical engineering pro-

fessor Don Bitzer to try to build an automatic teaching machine.

Bitzer teamed up with Peter Braunfeld and by June of 1960 PLATO I (Programmed Logic for Automatic Teaching Operations) was born. PLATO derived its computational power and memory from Illiac I, the University's computer. In January 1961 PLATO II appeared with two terminals, then in March the first remote terminal was used. PLATO then blossomed into what it is now with many terminals on campus, and terminals as far away as Japan.

The orange plasma display seen on PLATO terminals is one of Bitzer's inventions. Plato is now available for home use, and will soon be adapted for interface with color televisions.

Another University professor and electrical engineer, William J. Fry, was interested in mapping neurological systems using ultra-high frequency sound waves. He received $50,000 for a year's work from the Office of Naval Research. Due to lack of available space, Fry moved his office to a steam tunnel and converted his office to a lab. Fry's brother Frank then designed a machine to propagate sound waves with enough directional precision to eradicate a particular tissue. Fry continued mapping brains of various animals, overcoming anatonomical difficulties as he came upon them.

In 1955 Russell Meyers called to inquire if Fry would be interested in trying ultrasonic human brain surgery in Iowa City. Fry tested victims of Parkinson's disease by destroying small portions of nerves with relative success. It is hoped that someday, with more advanced equipment and computerizaton, the human brain can be mapped by this method.

Another University related breakthrough was made in the late 50's. When the atomic submarine was designed, a major feature was its ability to stay submerged for longer periods of time than conventional subs. The only drawback was that the sub was forced to surface periodically to change the batteries which ran the gyroscope. Arnold Nordsieck realized this problem could be overcome by building a magnetically suspended gyro which could rotate for long periods of time on its own. He convinced the people at Control Systems Laboratory to undertake this project.

Daniel Alpert and Howard Knoebel presented a model which showed that such a project was indeed possible as long as a good vacuum was maintained and the spherical rotor was very light weight. They decided to use beryllium in the rotor design for various reasons despite its extremely high cost. Nick Vassos built the housing which required tolerances of 50 millionths of an inch to maintain the vacuum. The whole gyro assembly was perfected in December 1963. This invention allowed the Navy's atomic submarines to be limited only by oxygen supplies.

Most are familiar with the red light emitting diode (LED) seen on watches and calculators. The man credited with the invention of it is Nick Hollonyak, an electrical engineer. The breakthrough was made while Hollonyak was working at General Electric.

In designing the red LED, Hollonyak used gallium and phosphorous to produce the color. Later, when the professor came to the University, he collaborated with graduate students to create orange and yellow LED's as well.

Education, medicine, construction, and electronics are some of the areas the people of the University of Illinois have helped expand. Many industries have been created or greatly affected by developments from the University.**T**

Join us now–before we become big and famous. And, that won't be long.

BEOCO—Bunge Edible Oil Corporation—is celebrating its first birthday. Our name is new, but we have years of expertise behind us. Having been an integral part of a major food processing company, we possess the technologies and facilities needed to reach our goals. And, we're on our way to becoming the number one supplier of shortenings, margarines and oils to the food processing, food service and baking industries.

Join us. And, from day one, you'll put your education to work. You'll start off in Production Management—working closely with top managers. And, most important, you won't be locked into bits and pieces of projects. You'll get a meaningful overview that will enhance your skills and equip you for increasing responsibilities. You'll also benefit from the vast resources of our parent company—the Bunge Corporation—a worldwide leader in processing, storage and shipping of agricultural commodities.

Right now, we have three major facilities operating at peak production. Whether you select Bradley, Illinois; Ft. Worth, Texas; or Chattanooga, Tennessee, you'll find a company dedicated to growth—yours and ours.

FOR DETAILED INFORMATION, CONTACT YOUR PLACEMENT OFFICE.

Or, write to Ms. L. Fidao, Bunge Edible Oil Corporation, P.O. Box 192, Kankakee, Illinois 60901. An equal opportunity employer, m/f.

Bunge Edible Oil Corporation

BEOCO

Graduate to a higher challenge. Texas Instruments.

For years you've been proving to your professors just how good you are. Now it's time to prove it to yourself.

With a higher challenge. With Texas Instruments.

Prove yourself where innovation's the rule, not the exception.

As a matter of corporate policy, TI has built-in budgets for new, innovative ideas. If you have a revolutionary concept that deserves to be put to the test, the money's there.

That's just part of the TI challenge.

Prove yourself in the world's "hot" technologies.

No technology is hotter, or more fantastic, than microelectronics. And no company is hotter in it than TI.

Example: The TI 59 handheld calculator has more than twice the primary memory capacity of the three-ton computers of the 1950s.

And look at these credentials. TI is:

- The world's leading supplier of semiconductors.

- The patent holder for the single-chip microcomputer and the handheld electronic calculator.
- The designer and producer of the most complex MOS chip *and* the most popular microcomputer.
- The inventor of solid-state voice synthesis.
- The largest producer of microelectronic memory products.
- The world leader in Very Large Scale Integration.
- The primary supplier of airborne radars to the U.S. defense program.
- The leading developer and producer of infrared and laser systems.
- The world's foremost geophysical survey company.

Prove to yourself where you have the freedom to grow.

Because TI is like many companies in one, you have the opportunity to move laterally from one specialty to another as well as move up. Without changing jobs.

TI's advanced system for lateral career mobility lets you move up faster. Because the freedom to move sideways is the best way to compare technologies and define career goals early on.

The frequently published TI *Job Opportunity Bulletin* lists openings at all TI facilities and gives TI people first crack at them.

Prove yourself where it counts.

TI has been acclaimed as one of America's best-managed companies because we've stayed young and vital while growing big.

One major reason for our high energy is our move-up environment. New people don't get buried at the bottom of a pecking order, because there isn't one. So if you get a good idea your first week on the job, it gets heard. And you get rewarded.

At TI, you get every chance to show what you can do. And prove what you deserve.

Prove yourself in an international company.

TI has hometowns in 19 countries on six continents. You'll find manufacturing in Singapore. Dallas. Tokyo. Nice. Buenos Aires. And many other cities around the globe.

TI has hometowns to match your lifestyle. No matter where you call home. From New England to Texas to California.

Texas Instruments is interested in graduates from the following specialties:

- Electronics Engineering
- Electrical Engineering
- Mechanical Engineering
- Computer Science (Software/Hardware)
- Industrial Engineering
- Materials Science
- Solid-State Physics
- Engineering Physics
- Engineering Science
- Metallurgy
- Metallurgical Engineering
- Chemical Engineering
- Chemistry
- Mathematics
- Plastics Engineering
- Manufacturing Engineering Technology
- Geology/Geophysics

Campus Interviews

TI Consumer Products Group. From calculators and watches to home computers, electronic learning aids and more.

TI Finance and Accounting. For group, division, corporate staff or multinational.

TI Digital Systems Group A leader in getting the computer closer to the problem through distributed logic and memory.

TI Equipment Group. Electro-Optics, Radar and Digital Systems, Missile and Ordnance.

TI Facilities Planning and Engineering. Responsible for facilities necessary for manufacturing and testing TI products.

TI Information Systems and Services. State-of-the-art computer systems and services to TI's worldwide operation.

TI Materials and Electrical Products Group. A world leader in engineered materials systems and home appliance and industrial controls.

Geophysical Service Inc. A world leader in the search for oil.

TI Semiconductor Group. Semiconductor components, materials and technology.

TI Corporate Research, Development and Engineering. Pioneering the technologies required by present and future business opportunities.

One or more of these groups may be interviewing on your campus. Check with the Placement Office for interview dates.

Or send data sheet to:
George Berryman
Texas Instruments, Corporate Staffing
P. O. Box 225474, M.S. 67, Dept. CJ4
Dallas, TX 75265

Fifty Years of Innovation

TEXAS INSTRUMENTS
INCORPORATED

An equal opportunity employer M/F

photo by Rob DeLand

Time For A "Computer" Change

by **Charley Kline**

The first floor of the Digital Computer Lab is occupied by several million dollars worth of computing equipment, and this equipment is by no means static. The University is constantly making additions and updates to its repertoire of machinery, a necessary task because computer technology is continuously changing.

The demand on the University's computer systems, an IBM 4341 and a Control Data Cyber 170/175, has been increasing steadily over the past several years. For this reason, the Computing Services Office decided to begin the hunt for a new addition to its family of computers. The decision was to introduce a new system, a Control Data Cyber 170/174, which theoretically has about one-half the straight computing power of the Cyber 175. This choice was approved by the Board of Trustees and the Cyber 174 was installed, brought up, and tested over the past semester break. It is now available for use during a test period after which it will be put into limited use for some computer science courses. It should be handling the bulk of the University's undergraduate computing load by the Fall 1981 semester.

According to the Computing Services Office's newsletter, **Offline**, a major factor in introducing a new system was to include timesharing, where programs are typed in from a terminal so the student can see the result right away, make changes, and run the program again. This will replace the old card batch method, where students spent long hours at a keypunch, fed their cards into the computer, and got their output from a printer. The growing opinion was that this present method for programming in 100-level computer science courses was somewhat outdated.

Since the Cyber 175 has had to assume an ever-increasing load of jobs, both from the advanced computer science courses and from research projects, it was becoming backed up and slow during the heavy usage period between 10:00 am and 5:00 pm. A new computer system would help to distribute the load. The 174 is expected to handle this load and can continue to do so for several years until the next system is brought in. According to CSO director George Badger, the budget will not allow this until at least 1984. Since the present setup at DCL involves complicated connections between the machines, the next system will most likely be either another Control Data machine or another IBM-compatible computer. Bringing in a new type of system would entail expensive and time-consuming changes.

CSO has also recently replaced its IBM System 360/75 with a newer IBM 4341, which has more capability than the 360 and runs the same programs while taking up far less space. The 360 consisted of many large cabinets while the 4341 is about the size of a dorm desk. The IBM System 360/75 had been in service for 11 years and was becoming extremely out-of-date.

The Cyber 174 and 175 and the

Clockwise from near left:

Operator Kathy Hatcher mounts a tape for a IBM 4341 user who requested one from a batch job. photo by Jim Lee

This poor punch card was very likely the victim of a computer science student's exasperation. Scenes such as this will soon be no more as the Cyber 174 will eliminate the use of punch cards in 100-level CS courses. photo by Brian Owens

Machine room chief Jack Knott looks over his computer operations.

IBM 4341 form a network of computers located at DCL. This network is maintained and serviced by a 24-hour crew of operators and engineers headed by Jack Knott. Ironically, the operators rarely see the actual computers they are controlling. Although the 4341 is located in the "machine room," both of the Cybers are located in the basement of DCL and usually require little attention themselves. Most of the work done by operators is done through three system consoles, one for each computer, where they control the computers and receive messages from them.

The machine room contains mostly peripherals—storage devices such as high speed disk drives for the 4341, tape units for all the computers, and a "mass storage" unit for the Cyber. This device pulls small magnetic cartridges from a large rack automatically, using an arm which can grab any cartridge and transfer it to a reader. In addition, the machine room contains a Digital Equipment PDP-11/50 computer, also used for computing work; a new device called a "switch" which will enable a terminal to access either the Cyber 174 or 175; and an Apple II-Plus microcomputer which will eventually be used to communicate information pertaining to all the computers to other locations on the campus.

As computers become more and more prominent in our society, very few engineers will enter their field without some experience on these machines. Fortunately for engineers here the University is constantly updating equipment to keep its computer systems in step with technology and need.T

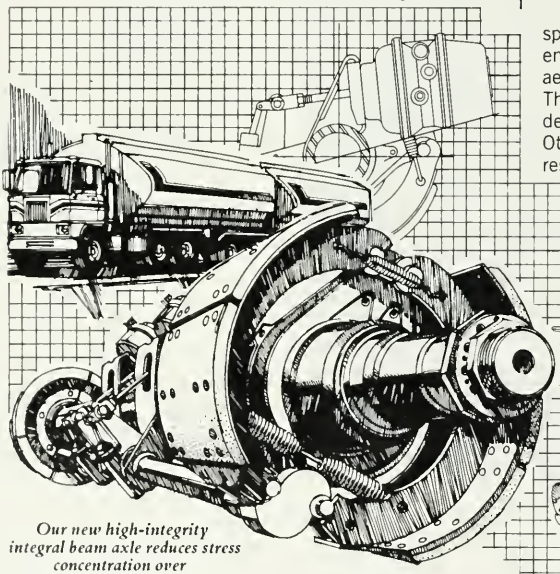
Rockwell International offers more than one kind of career challenge.

Much more.

Automotive.

One-half of the highway tandem tractors in North America are equipped with our axles — and more than half of the heavy-duty trucks stop with our brakes. We're also a major supplier of drivelines, steel and styled aluminum wheels, mechanical devices, castings and forgings, stainless steel wheel covers and components for light and heavy trucks, passenger cars, vans and buses.

We have the country's largest independent automotive components research facility. This is one reason we're able to produce innovative products like our new high-integrity integral beam axle. It's designed to lengthen trailer axle life by reducing stress over its entire length. Rated at 10% higher capacity, it's ten pounds lighter than competitive axles.

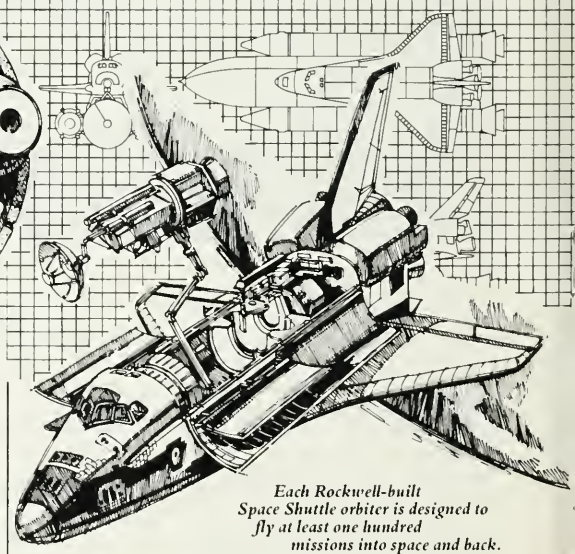


Our new high-integrity integral beam axle reduces stress concentration over the entire length of the axle.

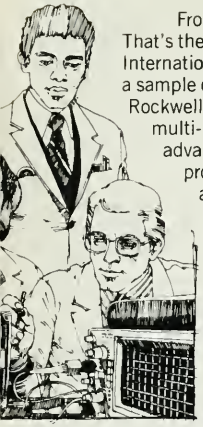
Aerospace.

We're prime contractor for the Space Shuttle orbiters, their main engines, and for integration of the entire Space Shuttle system. Since the engines and orbiters are reusable, they will help lower the cost of bringing the benefits of space down to earth.

This, the most advanced project in the history of space, is just one of our aerospace activities. Our rocket engines have played an important role in America's aerospace accomplishments including Apollo, Atlas, Thor and Saturn. We also have a long, proud history as a designer and builder of business and military aircraft. Other aerospace projects include satellites and advanced research in all aspects of aviation and aerospace.



Each Rockwell-built Space Shuttle orbiter is designed to fly at least one hundred missions into space and back.



From truck axles to Space Shuttles. That's the kind of company Rockwell International is — and shown below is just a sample of the kinds of challenges we offer.

Rockwell International is a major multi-industry company, applying advanced technology to a wide range of products in its automotive, aerospace, electronics and general industries businesses. A company that has shown sales and earnings growth every year since 1975.

We'll soon be on your campus and campuses all over America to recruit engineering graduates for the hundreds of positions we have available. These are a few of the disciplines we're looking for: *Electrical, Mechanical, Industrial, Aerospace, Civil and Chemical Engineering plus Computer Science, Physics and Chemistry.*

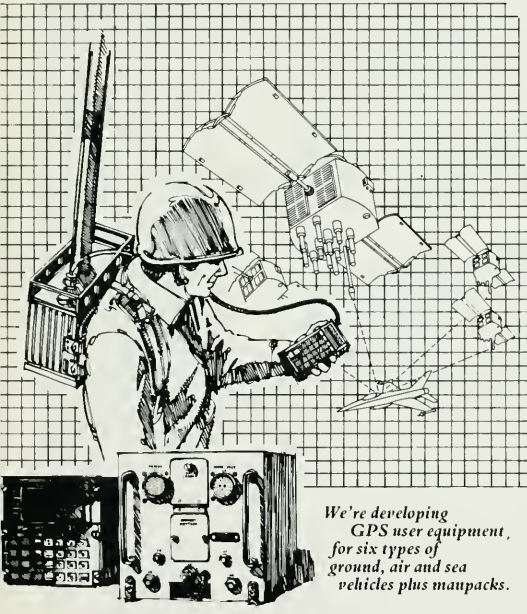
You'll have the opportunity to work with the engineers and scientists who've successfully pushed the state of the art of so many technologies. What you can learn from them will offer unparalleled opportunities for professional growth and pride of accomplishment.

We provide an excellent package of benefits including programs of in-house education and tuition reimbursement for advanced studies.

Check your campus Placement Office for details on Rockwell career opportunities and their locations. Then arrange for an interview with the Rockwell recruiter on your campus.

Equal Opportunity Employer M/F

Electronics.



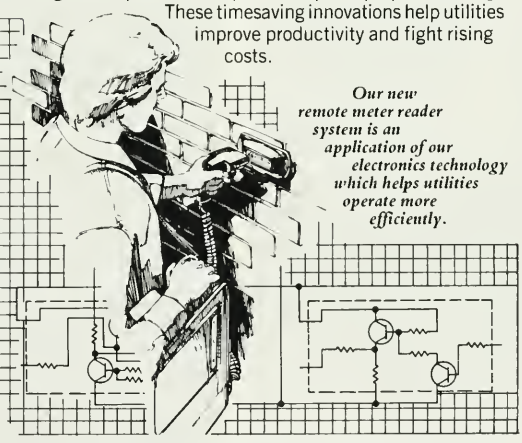
We're developing GPS user equipment for six types of ground, air and sea vehicles plus manpacks.

Among our many electronic products is user equipment for the Global Positioning System (GPS). Using data from Navstar satellites built by our Space Systems Group, this equipment will enable GPS users to pinpoint their positions to within 30 feet on land, at sea and in the air.

Our electronics businesses also produce extensive lines of telecommunications products and systems. In addition, we're one of the world's leading suppliers of avionics for air transport, general aviation and military aircraft. We're also a major defense electronics supplier and we produce a variety of microelectronic systems and devices, including industrial and commercial bubble memory systems.

General Industries.

Our General Industries Operations make a wide variety of gas and water meters — even instruments that read water meters electronically. One records readings on magnetic tape for subsequent computer-prepared billing. These timesaving innovations help utilities improve productivity and fight rising costs.



Our new remote meter reader system is an application of our electronics technology which helps utilities operate more efficiently.

We're a leading supplier of high-technology valving used in the production, transmission and processing of oil and gas. Our extensive technology is also being applied to the world's growing need for alternate energy sources: projects for nuclear energy, coal gasification and coal liquefaction systems. In addition, we make a line of industrial and consumer power tools, and we're a world leader with our Goss printing presses and Rimoldi industrial sewing machines.

Rockwell International

...where science gets down to business

Automotive/Aerospace
Electronics/General Industries

Rallies, Ribbons and Rabbits

Rallies, ribbons and rabbits—1981 is only a month and a half old but it has already had its share of local and international activity. While students were going through the usual routine of registration and recreation during New Student Week, they were also gripped by the hostage's return and the inauguraton of a new president. In spite of all this, the Altgeld Bells remained aloof in their lofty tower acting as if they had seen it all before.

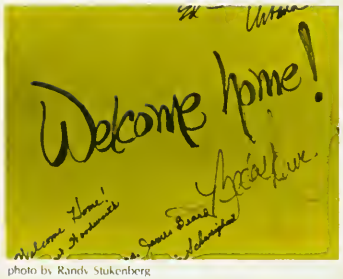


photo by Randy Stukenberg

photo by Randy Stukenberg

photo by Randy Stukenberg

Clockwise from above left: *The best news this year is the return of the hostages. Although it was not around an old oak tree, this giant yellow ribbon at Lincoln Square Mall helped welcome them home. At an anti-Reagan rally on the Quad, a protestor finds out that politics is a cold business as she uses her poster to block a cold inauguration day wind. The Altgeld Bells once again rang in the new year. Chalk-one-up for Tom Miltonberger as he corners this shot at the Illini Union Billiard Room. Joan Bockhorst receives a kindly carrot from Hoppy, the Registration Rabbit, who is really Mike Spies in disguise. Handy wrap! Randy Blum meets with some gripping resistance on his way to an IMPE basket.*

photo by Michael Lachman

photo by Randy Stukenberg

photo by Randy Stukenberg

TECH

Bell Laboratories engineer Mildred Paret with improved manhole cover. photo courtesy Bell Laboratories

MORE COVER THAN MEETS THE EYE

You may have to look closely to notice the differences, but new and lighter Bell Labs manhole covers are gradually appearing in streets across the country.

Not only is this the first major redesigning of the standard telephone company cover in 52 years, but it also marks the first in the field—the manhole cover's designer is a woman.

Mildred Paret, a member of the technical staff at Bell Labs in Whippany, New Jersey, and the first woman civil engineering graduate of Cooper Union in New York City, is responsible for the updated design. Her new manhole cover incorporates several more advantageous features.

According to Paret, Bell Labs "wanted to design a cover that was lighter in weight, especially with more women entering telephone company craft positions." The new cover weighs about 250 pounds compared to the 315 pounds of the old cover.

"It has a tapered solid underside, which reduces its weight, but has additional material at stress points, which gives the cover more strength. Under test conditions, the old cover withstood loads of up to 60,000 pounds but the new cover will withstand loads of up to 80,000 pounds. These loads were applied to the cover to simulate the contact area of a motor vehicle wheel," Paret noted.

The design also eliminates the bolts craftspeople had to replace in the field. Now there is a locking bolt mechanism that permits the cover to be replaced in any position. The bolt assembly can then be rotated to lock it in place. Furthermore, a special gasket is used which fits snugly around the cover and prevents water damage.

But perhaps the most easily noticed difference is the new Bell System Logo which provides quick identification of Bell System manholes for telephone company crews.

YOUR NUMBER IS UP

The central theme of this year's Engineering Open House is "Building on Dreams." The annual event will be held on March 6 and 7. The participating organizations need fellow students to help out with everything from running exhibits to setting up chairs. Anyone interested in assisting should contact one of the following Engineering Open House representatives:

American Foundrymen's Society, Kevin Connolly; 344-7113

American Institute of Aeronautics & Astronautics, Neil Cothran; 367-9609

American Institute of Chemical Engineers, Anthony Cacich; 344-4379

American Institute of Industrial Engineers, Janet Fath; 344-2255

American Nuclear Society, Jerry Stephenson; 333-2562

American Society of Agricultural Engineers, Julie Benoit; 332-4507

American Society of Civil Engineers, Chris Dunne; 384-4238

American Society of Mechanical Engineers, Gene Kornota; 328-4893

Associated General Contractors, Phil Stolarski; 384-9502

Association for Computing Machinery, Mark Tebbe; 332-4080

Bioengineering Society, Deanna Daniels; 356-0221

Black Engineering Student Association, Tony Coleman; 332-4014

Chi Epsilon (Honorary Civil Engineering), Thomas R. Kaetzer; 328-2278

Eta Kappa Nu (Honorary Electrical Engineering), David W. Archer; 332-3986

Illinois Society of General Engineers, Rory Dunn; 398-8059

Institute of Electrical and Electronic Engineers, Steven H. Mason; 328-7436 or 337-7511

Institute of Transportation Engineers, Jim Fischer; 332-4096

Physics Society, Mark Snyder; 332-4135

Pi Tau Sigma (Honorary Mechanical Engineering), Craig Miller; 367-8208

Society of Automotive Engineers, Tom Ortlieb; 356-4505

Society of Women Engineers, Kim Lawson; 332-4433

Student Branch of the American Ceramic Society and Keramos, Mary Kerr, 332-4325

SYNTON (ham radio), Ray Baker; 344-6885

Tau Beta Pi (all Engineering Honorary), Nabil Zahlan; 351-1896

Theoretical and Applied Mechanics department (also American Academy of Mechanics), Eliot Zaiken; 384-0888

University of Illinois Metallurgical Society, Dick Michel; 367-0141

"WADA BESA AKSHON"

On the engineering sports spot-

NOTES

by **Mark Wilson**

light—the results of Engineering Council's annual bowling tournament are finally in. The Black Engineering Student Association (BESA) dominated the tournament, taking first and second place. The winning team was led by Lamont Young (184 average) with consistent performances from Dean Parker, Michael Terry, and Karen Duster. Their 28 inch first place traveling trophy will remain with their organization until next year's competition. BESA's second place team was comprised of Dean Michael Jeffries, Lolita Smith, Wadell Brooks, and Rafael Diaz.

Leading the American Institute of Industrial Engineers (AIIE) to a third place finish was Greg Wada. Wada's average of 210 topped everyone as he walked away with the trophy for best individual performance. Wada admitted that he had a slight competitive advantage since he also bowls for the Illini. Rounding out the AIIE team were Bill Halley, Sue Raeber, and Professor M. Ghiassi.

U.S. SAFETY FILM WINS INTERNATIONAL AWARD

The recently released safety film, "Shake Hands with Danger," brought the United States a first place award in competition at the 21st International Industrial Film Festival in Copenhagen last fall.

This is only the second time in more than a decade that an American informational film has brought back top honors. Both first place awards were in the safety education category and were won by films released by Caterpillar Tractor Company.

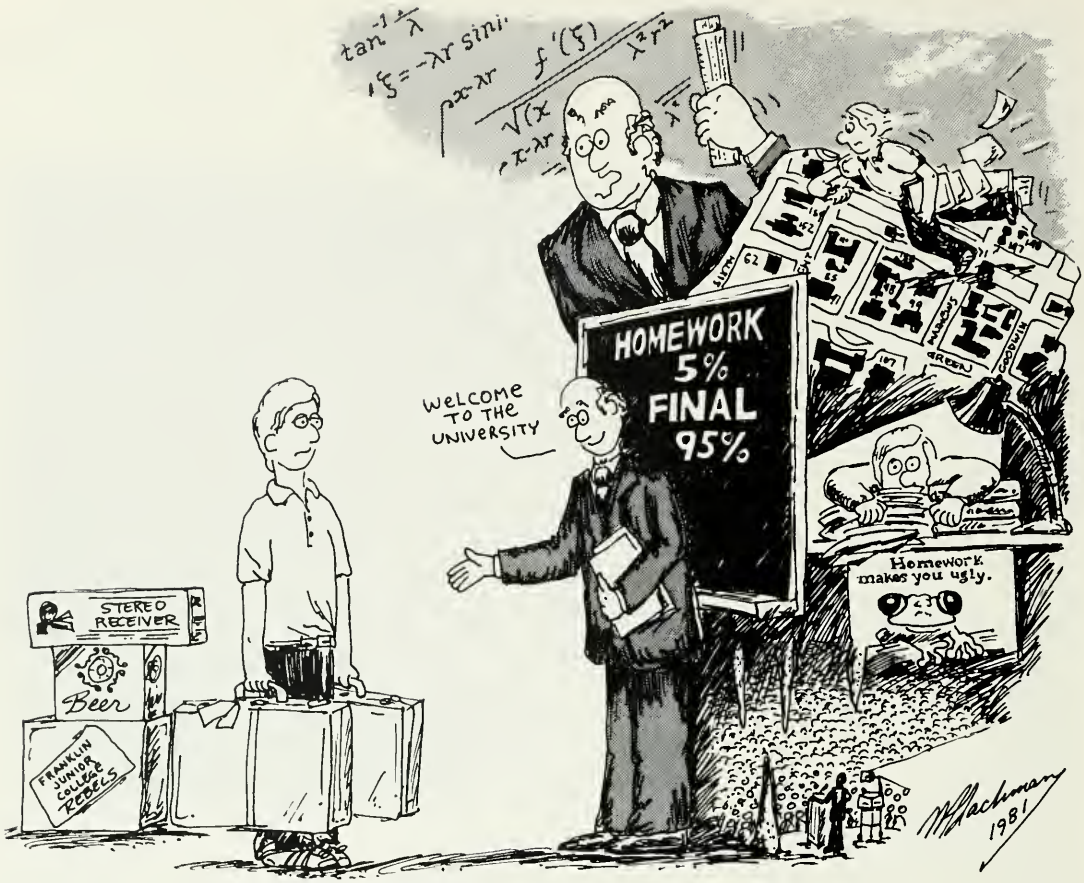
"Shake Hands with Danger" points to hazards in servicing and maintenance of heavy equipment. The target audience is the experienced mechanic or owner/operator, who may have become overconfident and careless with their work.

Stuntmen and special effects professionals were used to recreate chilling accident case histories. Realism and intense drama help the audience to identify with the situation and remember the warning long after viewing the film.

The 16mm color film may be obtained for local showing from Caterpillar Dealers.

An Engineering Open House helper demonstrates a perpetual motion machine. EOH will return on campus March 6 & 7. photo by Randy Stukenberg

A narrow escape for a heavey equipment operater in Caterpillar's award winning safety film. photo courtesy Caterpillar Tractor Company



Transfer Students Make The Grades

by **Dirk Andreas**

A common picture of a university includes many grey-haired, slide-rule wielding professors in cavernous lecture halls, piling mountains of homework on innocent, unsuspecting students. Actually, some students who have already been exposed to college share this vision with the uninitiated. But why? Well, they are not normal engineering students. They are engineering transfers.

These students are not really alone in this predicament. Four-hundred and ninety transfer students registered for the engineering curriculum last semester at the University of Illinois. Therefore, the fall of 1980 transfers represent approximently 11% of a total engineering population of 5600. This is a 57% increase in engineering transfer enrollment from the fall of 1978.

Thirty students from Eastern Illinois University registered for classes last fall, the largest of any school. The rest of the transfer students were from other four-year schools and junior colleges throughout Illinois and other states.

The requirements for in-state students are at least a 3.7 (A5.0) grade point average and junior standing (60 credit hours). Anyone from out of state must have at least a 4.7 GPA and have junior standing. However, once a student transfers to the University of Illinois they have no GPA. This keeps the class standings of the returning students intact.

Most transfers do not like this arrangement, because statistics show that the majority of transfer students' GPA's drop about .5 from their junior college average in their first semester. After the second semester, a transfer's GPA will go back up and generally be as

good as or better than the returning students.

Most students transfer to the University of Illinois because it is a state school and has an excellent reputation as an engineering school. Jeff Smith, a mechanical engineer who attended Lincoln Land Community College says, "I worked with University of Illinois graduates who were able to perform their jobs very well...they said they received an excellent education."

There has been a gradual rise in the minimum entrance requirements. According to Dean Carl S. Larson, "The quality of the student has risen...for a ten year (1967-77) period about 40% of transfer students had a GPA of 3.7 or less, now that's the minimum..." But the class they joined also has a sparkling reputation. Fifty-two percent of the class that entered in engineering in the fall of 1978 had an American College Test (ACT) score of 28 or above.

The University of Illinois is known for its quantity as well as its quality. Last year, the College of Engineering was second in the nation in the number of bachelor degrees given in engineering (Purdue was first).

However, along with quality and quantity comes competition. A top transfer student may end up being just "average" after transferring to the University. An electrical engineer from McHenry County College, Chet Kuryleiw, states, "The competition is fiercer than before. All the students are striving for the good grades. You just can't let up."

The College of Engineering works closely with many junior colleges and four year schools to design programs that will enable prospective students to transfer with the least amount of hassle. These programs help the student to be well prepared as well as retain credit for the majority of class work completed. Transfer students usually have no problem with credits.

A common fear among transfer students is that they are academically behind their new classmates. However, this fear is not really valid. As Dean Larson says, "Transfer students are new to engineering, but so are the returning students." He went on to explain that the returning students may be only two or three engineering courses ahead of the transfer students. On the other hand, the transfer student is usually a couple of free electives ahead of the returning student. Because of this, both students are at approximately the same place in the engineering curriculum.

What do engineering transfers think of the University of Illinois? "The standards for the courses are much higher than before...this coupled with the much more frantic pace makes it harder," said Roy Passfield, junior in electrical engineering.

Some problems transfers face are the same as those of incoming freshmen. They share the difficulties of more competition, larger classes, and being away from home. However, the transfer students do fare better than their freshmen counterparts. This is mainly due to the screening process the University of Illinois employs. For a 12 year period (1966-78), engineering transfers had a 17% dropout rate and the freshmen in engineering had a 27% rate. However, these figures should not cause alarm. Most students do not drop out of school, but enroll in another college at the University.

Hopefully, the dropout rate will not increase this semester. For if they make it, transfer students can soon feel at home at the University of Illinois. Because after break, they will return to campus with the distinction of having been transformed from transfer students into "normal" engineering students.**T**

SCIENCE/SCOPE

Field-effect transistors are emerging as strong contenders for microwave switch applications in communications satellites. Gallium-arsenide FETs are likely to replace PIN diodes due to advantages like higher speeds and lower power consumption. Using arrays of FETs, Hughes researchers built an 8x8 switch matrix for time-division multiple-access applications at 4 GHz. The device achieved a 1-nanosecond transition time at 10 milliwatts drive control power.

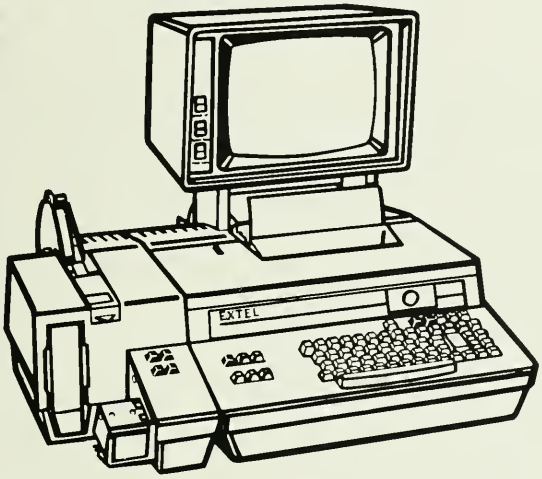
The unique method for ejecting Leasat satellites from the cargo bay of NASA's Space Shuttle -- a process that has been likened to flipping a flying disk -- has been proven in simulation tests. In a test designed to imitate the zero gravity of space, small explosive charges were fired to release a mock spacecraft weighing 15,000 pounds and measuring 14 feet in diameter. The simulated craft, hung from a 70-foot cable attached to a low-friction trolley, cleared its cradle and the bay as expected. Hughes is building five Leasat satellites to fill the communications needs of the U.S. Navy and other services.

A new weather satellite is gathering experimental data while continuing to provide conventional meterological information. GOES D, the fourth Geostationary Operational Environmental Satellite, carries a new sensor called a visible-infrared spin-scan radiometer atmospheric sounder (VAS). In addition to providing pictures every 30 minutes, VAS measures temperatures and moisture in the atmosphere at various altitudes. The data gives meterologists a more complete three-dimensional analysis of weather conditions. GOES D is the first of three spacecraft under contract to Hughes from the National Aeronautics and Space Administration, which is procuring the satellites for the National Oceanic and Atmospheric Administration.

Hughes needs graduates with degrees in EE, ME, Physics, Computer Science, and Math. To find out how you can become involved in any one of 1,500 high technology projects, ranging from subminiature microcircuits to advanced satellite technology, contact: College Placement Office, 100/445-SS, Hughes Aircraft Company, P.O. Box 90515, Los Angeles, CA 90009. Hughes is an equal opportunity employer.

A revolutionary mosaic infrared seeker, which creates TV-like pictures of a scene's radiated heat to allow missiles to lock on and guide themselves to tactical military targets, promises to provide increased performance at reduced size, cost, and complexity. The seeker incorporates more than 1,000 infrared detectors mated to a corresponding number of charge-coupled devices used for signal processing. All these elements are located at the focal plane of the seeker. Unlike conventional sensors, which mechanically scan a scene, the focal plane array "stares" at an entire scene.

Extel Corporation, a leader engaged in the design and manufacture of state-of-the-art microprocessor based telecommunicatons equipment, will be at the Campus Placement Office:



TUESDAY, MARCH 10, 1981

Interviewing for:

Electrical Engineering
Mechanical Engineering
& Computer Science

Positons available at the Northbrook, Illinois Corporate Headquarters. If unable to interview on the above date, please write or phone:

Janet Gazinski
(312)291-2637

EXTEL
CORPORATION

3005 MacArthur Blvd.
Northbrook, IL 60062

Equal Opportunity Employer m f h

A CULTURAL EXCHANGE

by **Jim Lee**

Clockwise from below:

The Great Wall of China is intricately detailed in this carpet-mural available to anyone for $29,500.

The world's first and simplest seismograph.

This display exemplifies China's potential for manufacturing high quality machine parts.

W. Yen, an industrial engineer, demonstrates an automated metal lathe for spectators. photos by Jim Lee

Exhibitions have traditionally been a time when people come together to see the newest in technology, works of art, athletic skills, or consumer products. Recently, many attended the first Exhibition of the People's Republic of China. The Exhibition toured the United States stopping in San Francisco, Chicago, and New York City.

The exhibition was organized and led by the International Import and Export Bureau (IIEB) of the People's Republic of China, with assistance from the United States Department of State, and numerous U.S. corporations and companies. The Honorable W. S. Lee, Deputy Director of the IIEB, along with his first secretary K. A. Wong, came to the United States with 73 people representing the different provincial districts of China. The group helped to exhibit over 200,000 different items of special interest.

Colorful silk flags lined the entrance to the exhibition. Classical Chinese paintings, handmade three-dimensional pictures, and many fine examples of beautiful Chinese calligraphy lined the walls and display cabinets.

The next section displayed textiles, clothing, and woven goods. Silk, one of China's main items of export, constitutes a major portion of the textile and clothing line.

One could not ignore the large mural-size carpets hanging in the next section. Prices ranged from $500 to $37,500 for hand woven carpets of wool. The carpets depicted life-like scenes of the countryside and famous landmarks in China. Smaller carpets of animals, including the panda bear and the Asian tiger, adorned the walls of more display cases.

The next section of the exhibition contained many precious furs and leathers fashioned into beautiful clothes and useful articles. The leather and fur industry in China is a strong one as harsh winters in Northern China demand warm clothing for its inhabitants.

One display of Chinese folk art that many people viewed was the ancient invention of a seismograph. The instrument resembled a vase with 12 dragon heads attached to the sides at equal intervals. Gold balls balanced in each dragon's mouth with small bowls resting beneath. In the event of an earthquake, this simple instrument would detect the slightest tremor by the fall of one or more of the golden balls. This seismograph was invented over 2000 years ago.

China's chemical engineering was displayed at its best with samples of all the naturally found elements and minerals in various parts of China. Processes for making chemical compounds and derivatives were shown in detail. Having many untapped, unexplored wells and fields, China has the capability to be a world supplier of quality crude oil.

Along with the industrial tools and processes, several displays consisting of finished steel goods were present. Further down were the electronics and electrical sections. Rows of digital electronic equipment were operating smoothly as an operator was close by to monitor its status. Small computers were displayed as they generated a variety of graphics and diagrams.

In the electrical section, numerous motors of various sizes, voltages, and horsepowers were shown as a large display of wire, both insulated and bare, showed spectators some aspects of China's electrical code. Large floor displays in the electrical section included two generating stations and a power distribution panel for a large generating facility.

Medical technology was next in line as displays of surgical instruments, surgical equipment, implants, and supplies were shown. Modern acupuncture equipment was a popular display item. Electrically charged needles giving a small shock is known to be more effective than the common acupuncture needle; ultrasonic acupuncture is under development as a new type of cure to many illnesses.

Optical instruments and photographic equipment followed. Examples of excellent lens manufacture and coating, and new photographic technology were seen, as well as powerful reflector and refractor telescopes. Laser-guided transits proved the accuracy of long distance laser beams. New photographic equipment included a compact 35 mm camera with infrared focusing, and several achromatic high speed lenses to accompany the new line of Pearl River professional 35 mm cameras.

For the lover of Chinese foods, the exhibition offered much. Resembling a supermarket in size and variety, glass cases held about every conceivable Chinese vegetable, prepared food, fruit, spice, candy, beverage, noodle, and pastry. Many Chinese liquors were shown as were the translated proof values for each. Moutai, a fragrant distilled spirit, was the most potent drink with a proof of 110.

The display ended on December 28, 1980 in New York. Many people will remember the first trade exhibition from the People's Republic of China as a colorful and exciting one.T

SET YOUR SIGHTS ON THE COMPANY THAT SETS THE STANDARDS.

The ELECTRONICS and SPACE DIVISION of Emerson Electric. Broad-based in product line. International in scope and influence. An innovator...setting the standards that others will follow for years to come. Emerson lists Flexible Armament Systems, Tactical Rockets, Airborne Ground Sensors, Radar and much more among its accomplishments.

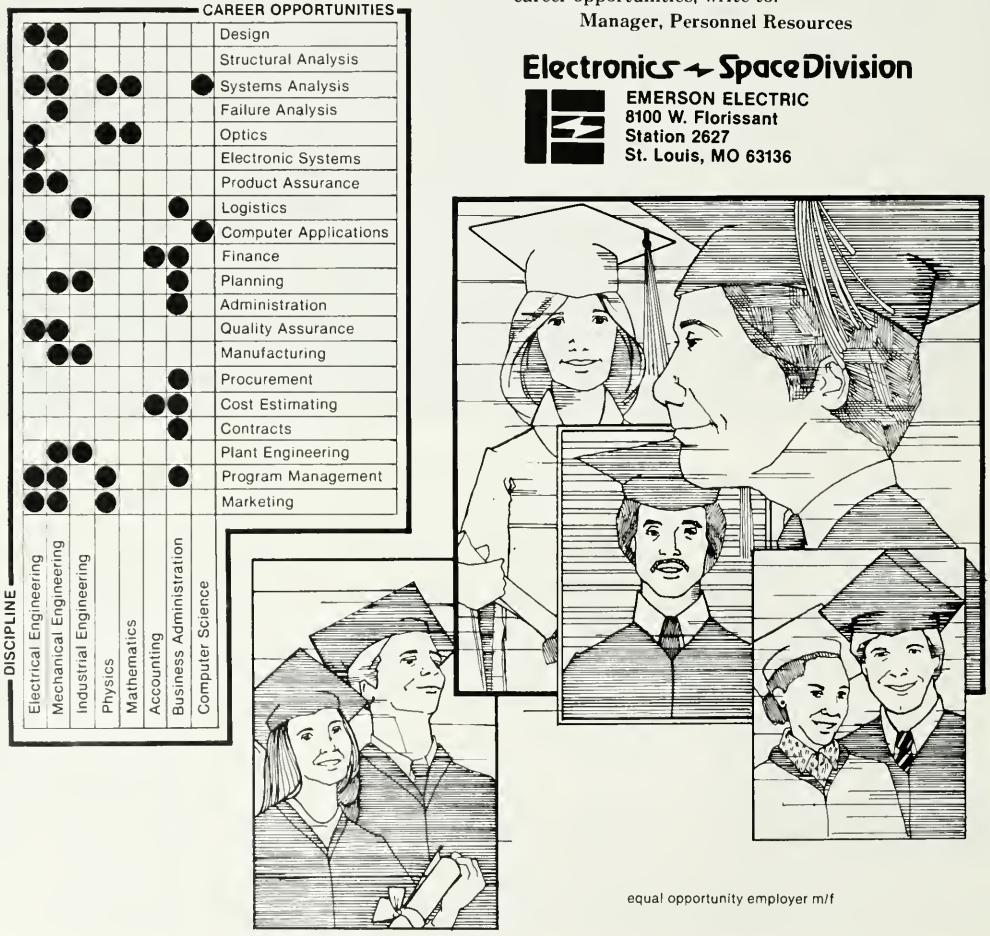
Emerson's ELECTRONICS and SPACE DIVISION is located in St. Louis, Missouri. Historic, Cosmopolitan. St. Louis is a city that boasts many recreational and entertainment opportunities as well as a superior standard of living.

The ELECTRONICS and SPACE DIVISION of Emerson leads the industry in quality and innovation. We offer top salaries and comprehensive benefits, as well as a superior professional environment. To learn more about these and other career opportunities, write to:

Manager, Personnel Resources

Electronics + Space Division

EMERSON ELECTRIC
8100 W. Florissant
Station 2627
St. Louis, MO 63136



equal opportunity employer m/f

EARN OVER $800 A MONTH RIGHT THROUGH YOUR SENIOR YEAR.

If you're a junior or senior majoring in sciences like math, physics or engineering, the Navy has a program you should know about.

It's called the Nuclear Propulsion Officer Candidate Program (NUPOC for short) and if you qualify, you can earn over $800 a month right through your senior year. Then after 16 weeks of Officer Candidate School, you'll get an additional year of graduate level technical education. This would cost thousands in a civilian school, but in the Navy, we pay you.

It isn't easy. There are fewer than 400 openings and only one of every six applicants will be selected. But if you make it, you'll have unequaled hands-on responsibility, a salary of more than $33,000 in four years, and gilt-edged qualifications for jobs both in the Navy and out.

Ask your placement officer to set up an interview with a Navy representative when he visits the campus, or contact your Navy representative at 800-841-8000, or send in the coupon. The NUPOC Program. Not only can it help you complete college. It can be the start of an exciting career.

NAVY OPPORTUNITY INFORMATION CENTER
P.O. BOX 5000, CLIFTON, NJ 07012

C188

Yes, I'd like more information on the NUPOC Program (OO).

Name _____ (First) (Please Print) (Last)

Address _____

City _____

State _____ Zip _____

Age _____ †College, University _____

‡Graduation Date _____ ◆GPA _____

▲ Major/Minor _____

Phone Number _____ (Area Code) *Best Time to Call

ECM1/81

NAVY OFFICERS GET RESPONSIBILITY FAST.

TECH TEASERS

Answers
From page 5

1. It takes a day and a half.

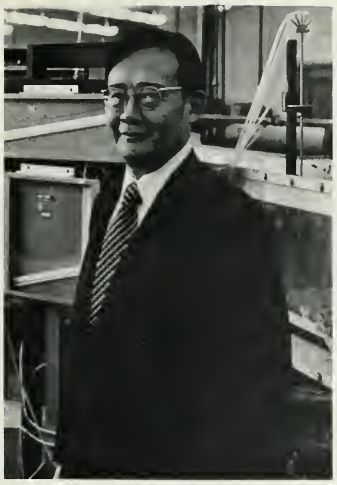
2. To grow half a foot takes half a month, regardless of the area.

3. Pour the contents of pail 2 into pail 5, and put pail 2 back where it came from.

4. One can show that the sums of the squares of the distances to the two diagonally opposite corners are equal. Thus the remaining distance is 3 meters.

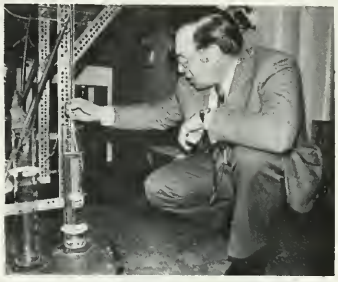
5. The explorer says, "I will be shot." If this were true, he would be hanged under the terms of the sentence. If it were false, he would be shot. Both of these outcomes are contradictory. Unfortunately the savages don't appreciate cleverness and the explorer is burned at the stake.

TECH PROFILES



SHAO L. SOO photo by Jim Lee

JAMES BEAUCHAMP photo by Rob DeLand



ERROL D. RODDA photo by Randy Stukenberg

Dr. Shao L. Soo came to the University of Illinois in 1959 as a professor of mechanical engineering. After obtaining his bachelor's degree at the National Chiao-Tung University in China, he received his M.S. at the Georgia Institute of Technology and his Ph.D. from Harvard University. "One becomes a professor because he or she is interested in teaching," said Dr. Soo. "This teaching responsibility comes in a broad sense: lectures, guiding the thesis research of graduate students, and teaching the public as a form of public service and creative work."

As a classroom professor, Dr. Soo teaches Applied Thermodynamics (ME 206) at the undergraduate level. His philosophy of teaching doesn't include drumming up an audience for lectures, but it does include giving the engineering student knowledge demanded by employers, and giving a clear picture as to the qualities of rigor and creativity needed by engineers.

Soo has served the public as a consultant or adviser on such organizations as the U.S. Environmental Protection Agency, NASA, the World Bank, and NATO. Due to his service he has been given many awards, such as the Fulbright-Hayes Distinguished Lecturer Award in 1979.

"To be able to do creative work here is intellectually stimulating. The facilities of the University and its students of high scholastic achievement have been a great help," concluded Dr. Soo.

James Beauchamp teaches several courses in both music and EE at the University of Illinois. His specialty is acoustics, electronic music and the hardware necessary for music synthesis and analysis.

He was an undergraduate at the University of Michigan and received his doctorate in electrical engineering with a minor in music at the University of Illinois in 1965. Beauchamp has taught EE and music here ever since, save for a year at Stanford working on a speech analysis project. For his doctorate and subsequent teaching requirements he helped develop one of the first electronic music studios in the United States, located in the music building on campus. Recently he helped with another project, the Playcomp system. This is a computerized synthesizer which is programmed on PLATO and downloaded to a local TI 980A computer (necessary for a uniform transmission rate) which operates the synthesizer and 4-channel playback system. The programming methods are very versatile and ideal for electronic music composition; one can compose in terms of anything from conventional musical notation to mathematical equations.

Beauchamp has been working on a project incorporating the Cyber 175 and IBM 4341 computers on campus to analyze waveforms and their resulting musical timbres. This is important in synthesizing accurate imitations of real sounds. He teaches music courses in musical acoustics and computer music, and EE courses in electronic music circuits and audio electronics.

Dr. Errol D. Rodda is a protessor in the agricultural engineering department and has done extensive work with grain drying and storage using dessicants to maintain quality and conserve energy. Currently, he is project leader of a five man team that is developing a general purpose system for the production of fuel alcohol. Dr. Rodda's part involves the actual production of the alcohol; he and his associates built a still in the agricultural engineering research building for this purpose. "Alcohol has real promise as an agricultural fuel," said Dr. Rodda.

Since earning his B.S. degree at the University of Illinois in 1951 and graduating with high honors, Dr. Rodda has led a challenging and busy career. He went to work for Caterpillar Tractor Company after graduation, and in 1958 returned to the United States from a position as field engineer in South Africa to continue his education. In 1960 he earned his M.S. in agricultural engineering at the University and a few years later received an M.S. in civil engineering with a structural background. His doctoral degree in agricultural engineering came from Purdue in 1965."

Dr. Rodda has been active on several committees, including chairman of the Grain and Feed Processing and Storage Committee and the Monographs Committee. A few of the honors he has received include the Stanley H. Pierce Award, Bronze Tablet, Knight of St. Pat, and he is listed in The National Register of Prominent Americans and International Notables.

Check Us Out

At Checkerboard Square

Engineering/ Data Processing

We're for people. Sure, we're number one in pet food, agricultural products and tuna processing. And growing fast in the mushroom business. But more than that, Ralston Purina is in the people business. Because without people we wouldn't be any kind of company at all.

Careers at Ralston Purina are people-oriented. That means responsibility, opportunity and challenge come with the job.

All kinds of jobs. Everything from design to production, project to process research and systems to data base analysis.

Whether computer science or whatever your engineering discipline, M.E., Ch.E., Ag.E., E.E., or C.E., CHECK US OUT. Arrange an interview when the Ralston Purina recruiter visits your campus. Or write to:

Corporate Employment Mgr.
Ralston Purina Company
Checkerboard Square
St. Louis, Missouri 63188

Ralston Purina Company

TECHNOVATIONS

by **Craig Moynihan**

LET THE SUN SHINE IN

Convertibles may be just another reason for nostalgia, but people still yen for that feeling of freedom associated with having the top down. Since having a solid roof is the law (with the exception of T-tops), Corning Glass Works has an enjoyable alternative. Corning has introduced a sunroof that filters out excessive light. The roof consists of a sheet of glass, a sheet of plastic, and a sheet of photochromic glass. The photochromic glass is of the same composition as Corning's Sunsensor sunglasses which darkens in response to the intensity of light. Thus, one avoids a noon-time sunstroke but is able to bask in the evening's moonlight. The only drawback is the abscence of that open air feeling. If that leaves you unsatisfied, maybe you should get a Harley instead.

ON THE LEVEL

David White Instruments introduces a new automatic level, the S-305W. The new auto level features a compact, lightweight design and weighs only 4 ¼ lbs. The builder's instrument is recomended for jobs up to 300 feet, requiring level accuracy of 0-1/16" at 150 feet. The correcting range of its compensator is ' 15 minutes of the angle.

The difference between automatic levels and conventional "manual" levels is the leveling compensator—a precise optical pendulum that uses gravity to correct the optical path through the instrument to the line of sight. The David White S-305W uses a unique optical arrangement that permits the compensator to be smaller, lighter in weight , and substantially more stable. This advanced design also provides twice the level correcting ability over most other compensator designs. Since there is less weight and less mass in the compensator to react to rough field use, the compensator is extremely durable.

TALK ABOUT FAST

Have you ever wished you could make that hour lecture go faster? Do you get weary of having to take pages of notes at a ridiculous speed? Are you sick of spending hours reviewing your notes? Well, the VSC Corporation may have the solution to your problems. They have introduced a speech compressor/expander. This machine can play a cassette from 60% to 250% of the normal speed, which ranges from about 90 to 375 words per minute.

The machine operates by sampling a high-frequency speeded audio signal at subaudible rates, discarding every other sample. The signal is then stretched out and returned to its original frequency. Any gaps left by discarded samples are then filled. Thus, one is able to listen to recorded speech at a rate faster than most people can read. The faster speed increases concentration, thus improving comprehension. So, you could listen to that hour lecture in less than half an hour. There is one slight drawback. The unit costs $495.

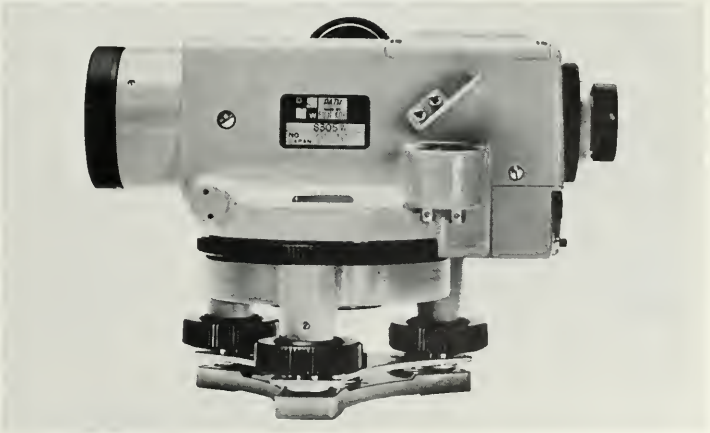
NASA NOTES

While the space shuttle has been a recent focus of media attention, NASA is also plodding along in other fields of research. A recent evaluation of NASA by a committee of the National Research Council Assembly of Engineering's Aeronautics and Space Engineering Board shed some light on some of these other projects.

One such project is the development of the tilt-rotor aircraft. These planes have rotors whose axes of rotation can be altered. Thus, the rotors can rotate parallel to the ground, allowing a vertical takeoff. They can then be rotated to their normal position and the plane becomes a conventional aircraft.

Another area of interest to NASA is turboprops. Turboprops have regained popularity because they are quieter than turbojets, permit rapid climb on takeoff, and save fuel. The committee urged extensive research in this field. A program to find new materials for turbine engines is under way and the committee asked NASA to consider political factors. Two metals used extensively in turbine engines, cobalt and chromium, are imported and the committee suggested that substitutes should be found.

Among other areas under investigation are the design of more efficient turbofan engines for commercial aircraft, the design of engines for STOL (short takeoff and landing) aircraft, the analysis of the problems of the SST, and the design of more efficient lean-burn engines to prevent damage to the ozone layer.



The S-305W features a unique compensator design.

"Will you find a rewarding career in the steel industry?

Charles Anderton
Penn State, 1976
B.S. Electrical Engineering
Electrical Engineer,
Sparrows Point Plant, Md.

Pat Metheny
U. of West Virginia, 1974
B.S. Industrial Management
Mine Superintendent,
Marion Coal Division,
W. Va.

"I did–at Bethlehem. And so did these engineers."

Walt Williams, President and Chief Operating Officer Bethlehem Steel Corporation

Claire Van Matre
Duke, 1977
B.S. Mechanical Engineering
Staff Engineer,
Buffalo Tank Division, N.J.

Juan Giscombe
Polytechnic Institute of New York, 1976
B.S. Operations Research and Systems Analysis
Industrial Analyst,
Burns Harbor Plant, Ind.

"When I joined Bethlehem Steel's management training program back in 1951, I wanted challenges and I wanted opportunities. As a civil engineer in a company that was growing and modernizing, I was given my share of both.

"Today the challenges and opportunities at Bethlehem Steel have never been greater. Sure the steel industry has problems. But here at Bethlehem we're hard at work solving those problems. We're strong financially. We're strong in raw materials. We're strong competitively. We're strong technologically. And we're strong in people.

"But we always need more people. Good people. New graduates. Engineers who aren't afraid of hard work. Who aren't afraid to rock the boat. Who want an exciting, rewarding career in the profession they've chosen.

"I invite you to join us and grow with us. Pick up a copy of our Loop Course booklet at your Placement Office or ask us for one. See for yourself what we've got to offer you. Write: Director—College Relations, Bethlehem Steel Corporation, Bethlehem, PA 18016."

Mr. Williams joined Bethlehem Steel's management training program (The Loop Course) in 1951 upon graduation from the University of Delaware with a B.S. in Civil Engineering.

Bethlehem BETHLEHEM STEEL

an equal opportunity employer

Picture yourself in electronics... at Kodak.

It can be an exciting picture for a new engineer or science graduate. Because Kodak is rapidly accelerating into the electronic technology of tomorrow. We need bright ideas and fast thinking to help us apply this technology to the more than 30,000 products Kodak markets.

That leaves no time for leisurely apprenticeships. You could find yourself immediately in projects involving microprocessors, microprocessor controlled servo systems, laser writing, digital data processing, analog signal processing, input/output interfacing, opto-electronics, or experiment monitoring and control equipment.

You may work on designing products, developing components that go into products, or creating equipment to manufacture components and products.

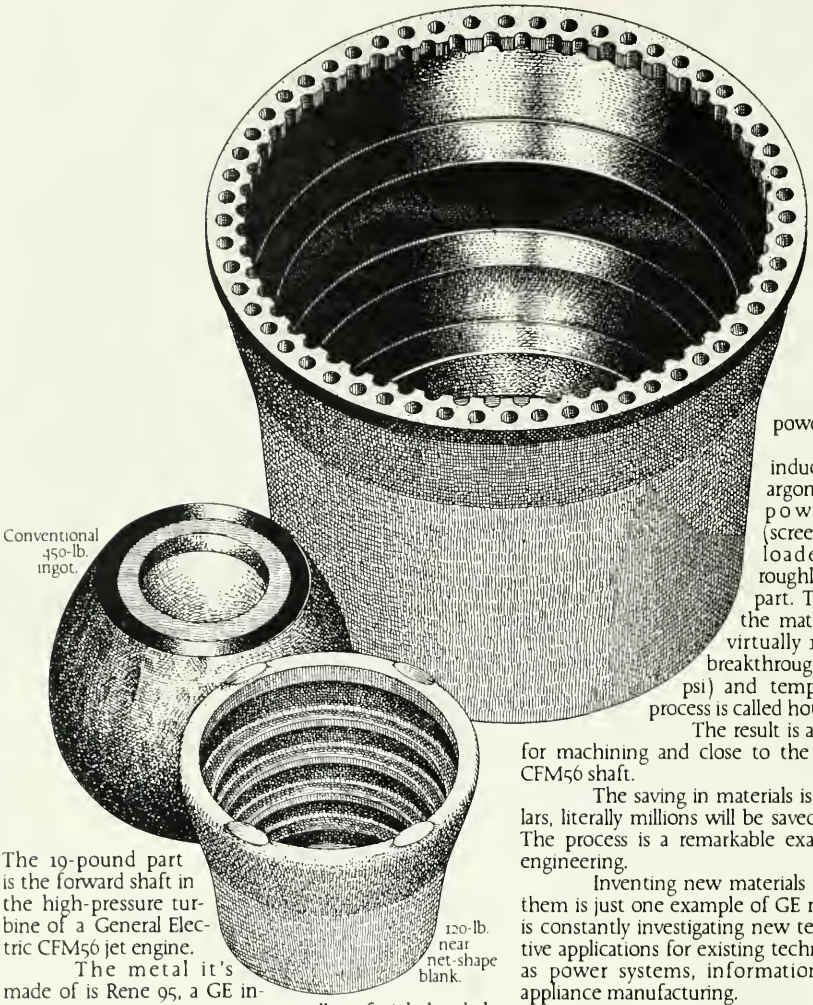
If you're interested in a career in electronics and have a degree with course work to match your interest, we look forward to discussing the diversity and opportunities you can enjoy with us. See a Kodak campus recruiter, or send your resume to

Personnel Resources,
Eastman Kodak Company,
Rochester, NY 14650.

Kodak

An equal-opportunity employer (f/m) manufacturing photographic products, fibers, plastics, and chemicals with plants in Rochester, N.Y.; Kingsport, Tenn.; Windsor, Colo.; Longview, Tex.; Columbia, S.C.; Batesville, Ark.; and sales offices throughout the U.S.A.

Why should it take 450 pounds of metal to make a 19-pound part?



The 19-pound part is the forward shaft in the high-pressure turbine of a General Electric CFM56 jet engine.

The metal it's made of is Rene 95, a GE invention. Rene 95 is an exotic superalloy of nickel, cobalt, columbium, tungsten and 17 other elements. To fabricate a forward shaft from Rene 95 by conventional methods, you start with a 450-pound ingot. After forging, pressing and machining, you end up with a single 19-pound shaft...and more than 400 pounds of expensive scrap.

That's a distressing waste of critical raw materials and of the energy it takes to mine and refine them.

So GE engineers turned to near net-shape forming: fabricating the finished part from a blank shaped as closely as possible to the shape of the finished part.

But how could such a blank be created without starting with a 450-pound ingot? To solve that problem, GE engineers developed a truly unique application of powdered metallurgy.

Virgin or vacuum induction-melted Rene 95 is argon-atomized to create a powder. The powder (screened for particle size) is loaded into containers roughly shaped like the final part. Then, in an autoclave, the material is consolidated to virtually 100% density (that's a breakthrough) at high pressure (15K psi) and temperature (2000°F.). The process is called hot isostatic pressing.

The result is a 120-pound ingot ready for machining and close to the shape of the finished CFM56 shaft.

The saving in materials is more than 70%. In dollars, literally millions will be saved over the next decade. The process is a remarkable example of cost-effective engineering.

Inventing new materials and better ways to use them is just one example of GE research in progress. GE is constantly investigating new technologies and innovative applications for existing technologies—in such areas as power systems, information services and major appliance manufacturing.

This takes talent—engineering talent—not just in research and development, but in design and manufacturing, application and sales.

If you are interested in engineering opportunities at GE, check your Placement Office or write to: Engineering, Bldg. 36, General Electric, Schenectady, New York 12345.

Progress for People

GENERAL ELECTRIC

An Equal Opportunity Employer